

REMARKS

Claims 16-39 are pending in this application. Non-elected claims 16-26 are withdrawn from consideration.

I. Claim Rejection Under 35 U.S.C. § 103

The Examiner rejects claims 27-39 under 35 U.S.C. §103(a) as being unpatentable over Maeda et al. (US 6,189,771) in view of Imamura et al. (US 2002/0185309), and further in view of Mei (US 6,680,128) in view of Kang et al. (US 5,837,119). Applicants respectfully traverse the rejection.

Claim 27 is directed to a soldering process comprising “a first step of supplying a flux comprising a liquid base material comprising a resin component which is dissolved in a solvent, an active component which removes an oxide, and **a metal powder made of a metal** which has a melting point higher than that of a solder material which forms the solder portion, **wherein the metal powder is in the form of scales**, and the flux contains the metal powder in an amount in the range between 1% and 9% by volume based on a volume of the flux, to at least one of the solder portion and the second electrode”. **Thus, the process of claim 27 uses a flux which contains a metal powder in the form of scales.**

Claim 33 is directed to a soldering process comprising “a first step of supplying a flux comprising a liquid base material comprising a resin component which is dissolved in a solvent, an active component which removes an oxide, and **a metal powder in the form of scales of which constituting elements are comprised of cores and coatings around the cores**, wherein the coatings are made of a metal which has a melting point higher than that of a solder material which forms the solder portion, and the flux contains the metal powder in an amount in the range between 1% and 9% by volume based on a volume of the flux, to at least one of the solder portion and the second electrode”. **Thus, the process of claim 33 uses a flux which contains a metal powder in the form of scales.**

The Examiner admits that Maeda et al. and Imamura et al. do not disclose metal powder in the form of scales (see Office Action, page 4, lines 6-7). However, the Examiner asserts that “it would have been obvious to one of ordinary skill in the art at the time of the invention was made to **include the flake-shaped powders of Kang in the solder paste of Mei** because this

produces a better electrical connection with a minimum of filler material” (see page 4, lines 12-15) (emphasis added). Applicants respectfully disagree.

There Would Have Been No Reason to Combine Kang et al. with Mei

Kang et al. disclose an electrically conductive paste (ECP) material consisting of copper powder coated with a thin layer of low melting point metal, Pb-free metals (see col. 4, lines 35-43). Applicants note that copper has a very high melting point of about 1083°C.

Mei discloses a solder paste comprising a solder material, such as tin, coated with a coating material, such as silver (see col. 2, lines 19-23).

In order to “include the flake-shaped powder of Kang in the solder paste of Mei”, as asserted by the Examiner, one of ordinary skill in the art would recognize that Kang et al. teach to use copper powder having a flake-like or plate-like shape (see col. 5, lines 35-39).

If Kang et al.’s copper powder were included in the solder paste of Mei, and the resulting solder paste were used for soldering, then the copper would remain in powder form in the solder connection portion that is formed by melting the solder material followed by its solidification. This would have resulted in a non-uniform solder connection portion in which copper powder would remain. One of ordinary skill in the art would recognize that the non-uniform solder connection portion has much less mechanical strength. Thus, the solder paste which would have been produced from the combination of Kang et al. and Mei could not be used to connect, for example, an electronic part onto an electronic circuit board. Therefore, one of ordinary skill in the art would not have had any reason to include the flake-shaped copper powder of Kang et al. in the solder paste of Mei to arrive at the presently claimed invention with a reasonable expectation of success.

In addition, it is well-known that copper forms a brittle alloy with tin. Therefore, one of ordinary skill in the art would have avoided using tin, as disclosed in Mei, together with copper, as disclosed in Kang et al. Accordingly, one of ordinary skill in the art would not have combined the references to arrive at the presently claimed invention with a reasonable expectation of success.

The Electric Conductive Path Formation

As seen from Fig. 3 of Kang et al., an electric conductive path is formed by the powder particles that are connected by the low melting point metal between the particles. In order to form a better path, the reference teaches to use flake-shaped powders for improved electrical

conduction (see col. 5, lines 36-40).

In Kang et al., the powders are not melted and their shapes are basically kept the same. Therefore, the powders should be made of a metal having a melting point that is higher than that of the solder material.

Mei teaches that the conductive path is formed by melting the solder material, followed by its solidification. Therefore, the path is formed of a solder material mass. Because the electric conduction performance of the conductive path depends on various factors, such as the shape of the solder material mass, the spreading (or wetting) property of the molten solder material, and the species of solder material used, one of ordinary skill in the art could have tried to change these various factors to improve the conductive path. However, because the solder material powder does not exist in the solder material mass, one of ordinary skill in the art would not have considered the particle shape in the solder material powder of Mei. Therefore, one skilled in the art would not have included the flake-shaped powders of Kang et al. in the solder paste of Mei.

In the claimed invention, the conductive path is formed by the solder material mass, which is induced from the solder potion of the electrode, and the metal powder does not form the conductive path (see Fig. 3 of the present application).

Applicants submit schematic drawings on the following page to describe the differences in electrical conductive path formations between Kang et al. Mei, and the present application. In the drawings, the thick broken lines with arrows on both sides represent the electric conductive paths.

Electric Conductive Path Formation

Kang

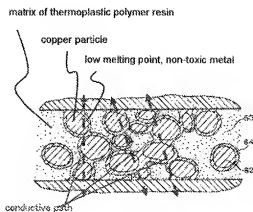
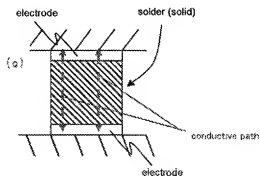
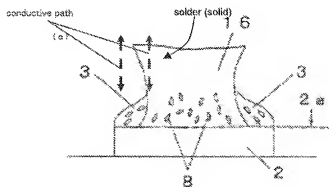


FIG. 3

Mei



Present Invention



In view of the foregoing, one of ordinary skill in the art would not have had any reason or rationale to combine the teachings of the references to arrive at the presently claimed invention. Therefore, one of ordinary skill in the art would not have included the flake-shaped powders of Kang et al. in the solder paste of Mei.

Accordingly, claims 27 and 33 would not have been obvious over the references.

Claims 28-32 and 34-39 depend directly from either claim 27 or 33, and thus also would not have been obvious over the references.

Therefore, reconsideration and withdrawal of the rejection are respectfully requested.

II. Double Patenting Rejection

The Examiner provisionally rejects claims 27, 33 and 39 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 4-6 of copending application No. 10/585,729.

The Examiner also rejects claims 27, 33 and 39 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 and 2 of US Patent No. 7,632,710.

Applicants respectfully request the Examiner to hold these rejections in abeyance, pending an indication that the claims are otherwise allowable.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the claims are earnestly solicited.

Should the Examiner find that anything further would be desirable in order to place the application in better condition for allowance, she is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

Tadashi MAEDA et al.

/Andrew B.

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